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Established 1800!

Some years ago we were motoring with Mr. C. W. Coleman, the well known moulding-machine expert, when he called our attention to a miserable little works situated in a back street of a provincial town. Below the name there was a disclosure that the concern was established in the year 1800, or thereabouts. "If that represents a hundred years of progress," commented Mr. Coleman, "it's about time they went out of business." About this time we visited a new installation, which was the third and final mechanisation, all carried out within the space of 10 years! Why then are there such differences to be reported in the progress made by various foundries?

So far as quality is concerned, it is true to state that some of the back-street concerns produce castings in every respect equal to the highly mechanised concerns. The answer, so far as we can see, is that the owners have been content to remain as jobbing founders, and have refused to specialise. But that is only half an answer, because it is possible to specialise as a jobbing foundry. We believe that the foundries which have made progress in the past were controlled by people who realised that they were not experts in every phase of business activities, and so by various means acquired the requisite type of brains. It was evident right up to 1939 that many foundry owners and directors still laboured under the illusion that there existed a "Jack of All Trades" capable of running foundries successfully. How often did one see advertisements for foundry foremen," who must be capable of (1) organising labour; (2) mixing metals to analysis; and (3) estimating and fixing piecework prices." Such people certainly exist, but whether they are really proficient in all three branches is doubtful.

The jobbing foundry owner will no doubt object that the size of his business will not permit the engagement of three separate officials. Then we suggest an analysis of his own personal activities and ascertain whether or not with the help of outside consultants he could not take over the estimating and metallurgical control himself, until such time as suitable personnel can be trained or acquired. The small foundries in France are to be retaught their catechism. A similar effort could with benefit be instituted in this country. Obviously the first item is a knowledge of true costs upon which to base an economic selling price. Next comes tidyness, or good housekeeping as it is now known. Finally, there must be instituted a simple system of technical control. Simultaneously, every effort must be made to improve the sanitary conditions of the works.

After a few years these old-established foundries will be more proud of "thoroughly modernised in 1945," than of "established *circa* 1800," as an indication of their ability to give service. Their fight will not be an easy one, as their skilled men are as conservative as the owners. Their shops are often ill-lighted, ill-ventilated, and too low. The floor is uneven and the handling facilities primitive and slow. In many cases an entirely new shop is really necessary. These difficulties have been overcome—some during the war. Two in the London area have in recent years made very intelligent extensions, whilst a third during its 20 years of existing has achieved a national reputation for quality.

A LENGTHY REPORT on "Plans for the Recruitment, Education and Training in the Coal-mining Industry"—it runs to 114 pages—has been prepared by Dr. R. W. Revans in conjunction with a committee of the Mining Association of Great Britain. Because of the nationalisation of the industry, it cannot be implemented by the sponsors, but no doubt the new set-up will avail themselves of its very enlightened provisions.

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FORTHCOMING EVENTS

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

JANUARY 18.

Institute of Welding (East Scotland branch) :—"The Layout for Welding," by W. A. Roy. At the Heriot Watt College, Chambers Street, Edinburgh, at 7.30 p.m.

Keighley Association of Engineers :—"Arc Welding Problems," by H. F. Tremlett. At Devonshire Buildings, Devonshire Street, Keighley, at 7.30 p.m.

Institution of Mechanical Engineers :—"Recent Extensions to the Steam and Power Plant at a Large Chemical Works," by G. A. J. Begg, W. M. Hebblethwaite, and G. Cooke. "The La Mont Boiler," by G. A. Plummer. At Storey's Gate, St. James's Park, London, S.W.1, at 5.30 p.m.

JANUARY 19.

Institute of Welding (West Scotland branch) :—Luncheon. At the Grosvenor Restaurant, Glasgow, at 12.45 p.m.

JANUARY 21.

Sheffield Society of Engineers and Metallurgists :—Presidential address. At the Royal Victoria Station Hotel, Sheffield, at 6.15 p.m.

Association of Bronze and Brass Founders :—Yorkshire area meeting. At the Great Northern Hotel, Leeds, at 12.45 p.m.

JANUARY 23.

Institute of Physics (London and Home Counties' branch) :—Inaugural meeting of the Industrial Spectroscopic Group. "The History and Present Status of Emission Spectroscopy as Applied in Industry," by Lt.-Com. J. Convey. At the Lecture Theatre, Royal Institution, Albemarle Street, Piccadilly, London, W.1, at 3 p.m.

Institute of Welding (Wolverhampton branch) :—"Modern Gas Welding Practices and Techniques," by F. Clark. At the Victoria Hotel, Wolverhampton, at 7 p.m.

Institute of Welding (South Wales branch) :—"Progress in the Application of Welding to Shipbuilding," by W. G. John. At Newport.

JANUARY 24.

Association of Bronze and Brass Founders :—Midland area meeting. At the Victoria Hotel, Wolverhampton, at 12.45 p.m.

Association for Scientific Photography (Medical Group) :—"Medical Photographer, or Photographing Medico," by B. Richardson Billings. At Hastings Hall, B.M.A. House, Tavistock Square, London, W.C.1, at 6 p.m.

JANUARY 25.

Manchester Association of Engineers :—"Colour as it Affects the Engineer in his Business of Everyday Life," by R. F. Wilson. At the Engineers' Club, Albert Square, Manchester, at 6.45 p.m.

Royal Statistical Society (Industrial Applications Section) :—Symposium on "The Reliability of 100 per cent. Inspection." At the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2, at 6.30 p.m.

Institution of Mechanical Engineers :—Thomas Lowe Gray lecture : "The Electric Propulsion of Ships," by G. O. Watson. At Storey's Gate, St. James's Park, London, S.W.1, at 5.30 p.m.

JANUARY 28.

Association of Bronze and Brass Founders :—Lancashire and Cheshire area meeting. At the Midland Hotel, Manchester, at 2.30 p.m.

JANUARY 30.

Royal Statistical Society (Industrial Applications Section) :—"Statistics in the War Effort," by Mr. Van Rest. At the University, Edmund Street, Birmingham, at 6.30 p.m.

Institute of British Foundrymen

JANUARY 19.

Lincoln section :—"Scientific Measurement in the Foundry," by A. Scattergood. At Lincoln Technical College, at 2.45 p.m.

JANUARY 25.

Birmingham, Coventry and West Midlands branch :—Annual dinner and dance. At the Botanical Gardens, Edgbaston, Birmingham.

JANUARY 26.

East Midlands branch :—"Modernisation and Mechanisation to Aid Foundry Production," by G. W. Nicholls. At Derby Technical College, at 6 p.m.

Bristol and West of England branch :—"The Technological Principles of Casting Design," by Prof. V. M. Shestopal (read by J. Rostron). At the Merchant Venturers' Technical College, Bristol, at 7 p.m.

Falkirk section :—"Cupola Practice," by D. H. Young. At the Temperance Café, Lint Riggs, Falkirk, at 6 p.m.

Wales and Monmouth branch :—"Technique in Production of High Strength Aluminium Castings," by A. L. Pendry. At the Engineers' Institute, Cardiff, at 2.30 p.m.

JANUARY 28.

Sheffield branch :—"Place of the Foundry in Industry," by F. Whitehouse. At the Royal Victoria Station Hotel, Sheffield, at 7 p.m.

JANUARY 30.

London branch :—Works visit to Ealing Park Foundry, Limited.

ADDITIONAL CLOTHING COUPONS FOR MANUAL WORKERS

It has been decided to issue for the current rationing period 10 additional clothing coupons to a wide range of manual workers. This extra ration, usually known as "The Industrial Ten," is similar to that given in the 1944/45 ration period, and the categories of workers eligible are substantially the same. The coupons will be issued as before through local offices of the Ministry of Labour and National Service to employers, for distribution to their workers. The coupons will be available to employers and Trade Union branches from January 3 until March 2, together with the necessary forms of application and a leaflet (reference TC/46), which gives full details of the workers eligible for coupons and the method of application.

THE GRAY IRON FOUNDERS' SOCIETY have awarded "Tribute of Appreciation" certificates "for distinguished service to the Government and the grey-iron foundry industry." The ceremony took place at the annual convention and "peacetime production conference" held in Chicago in October last. Those honoured were Mr. Edward P. Buchanan, pig-iron division, Pittsburgh Coke & Chemical Company, Pittsburgh; Mr. A. Douglas Hannah, chief, forgings and castings branch, steel division, War Production Board, Washington; Mr. Edward C. Hoenicke, assistant to the general manager, foundry division, Eaton Manufacturing Company, Detroit; Mr. William Kerber, assistant to the president, Hanna Furnace Corporation, Buffalo; Mr. Frank G. Steinebach, of Cleveland, editor of "The Foundry"; and Mr. Donald J. Reese, head of the iron and non-ferrous castings section, development and research division, International Nickel Company, Inc., New York City. The presentation of the awards was made by Mr. Walter L. Seelbach, of Cleveland, president of the national trade group.

BRITISH PIGIRONS, LIMITED, are closing down their offices at Little Court, Woking, and returning to Abbey House, 2, Victoria Street, London, S.W.1.

THE BRITISH STANDARDS INSTITUTION, in its latest monthly information sheet, lists among new work started impact testing for cast iron.

TEMPERATURE MEASUREMENT BY MEANS OF AN IMMERSION PYROMETER*

Obtaining accurate results from equipment economical in cost

By E. HUNTER, A. R. PARKES, and J. W. DEWS

The measurement of molten metal temperatures in the ferrous foundry has not received the attention which is due to such an important factor. This cannot be due to ignorance, as the science of pyrometry has been well known for many years, and other industries have made good use of temperature control.

The probable reason for this apparent lack of interest was the ease with which phosphoric irons could be melted and cast. The advent of the Meehanite process by which high steel mixes could be melted under control, brought with it the necessity for temperature control, as these high steel mixes, having a higher freezing point and shorter solidification range, are much more sensitive to temperature changes. The use of statistical control charts as a means of maintaining consistency of mix and resultant product are not fully effective unless every other known factor is similarly controlled.

Technical control, however, must be kept within reasonable limits of cost, therefore the method by which the temperature measurement is made must not be too costly. This particularly applies to the manufacturer of light castings, who uses a much smaller ladle than the maker of heavy castings, and therefore has more taps per melt. The efforts of the Authors were therefore directed towards producing an accurate method of temperature control at a reasonable cost.

Requirements of Measuring Equipment

The chief requirements of the equipment to measure molten metal temperatures in the foundry must be accuracy, simplicity and robustness, while consideration of initial and maintenance costs, together with cost of operation, must be offset against the increased measure of control obtained and the value of that control in terms of better castings. It was with these factors in mind that the preliminary inquiries were set in motion.

Optical pyrometers of the disappearing filament type have been used in the foundry for some time, but the limitations of these instruments are well known. A survey of the literature on measurement of molten metal temperatures revealed the fact that considerable research work had recently been carried out on molten steel temperature.[1,2] Immersion thermocouples of the rare metal type were used suitably insulated and in conjunction with E.M.F. measuring instruments of the millivoltmeter or potentiometer type. A report in THE FOUNDRY TRADE JOURNAL[3] indicated that this type of immersion couple could easily be adapted for iron-foundry use. Results obtained when the couple was used as a control method for pouring temperatures were stated to be very encouraging. Further inquiries from a local steel foundry brought a wealth of detailed advice and practical assistance.

As these investigations were to some extent in the nature of a research, it was decided to use a potentiometer for measuring the E.M.F. rather than a millivoltmeter type of instrument, despite the fact that the millivoltmeter is self indicating, whilst the potentiometer necessitates an operator. The potentiometer, however, permits of more accurate E.M.F. measurement over a wide range, and is independent of the type of couple with which it is used. Furthermore, there were available two excellent types of potentiometers, which, apart from being used for temperature measurement in the research laboratory, are also used for checking the thermocouples and recording instruments on the Authors' annealing ovens, drying stoves, etc.

Types of Potentiometer

The two types of potentiometer used are of the workshop type. One, illustrated in Fig. 1, made by Negretti & Zambra, is the quick-reading type developed specially for molten metal temperature measurement.[5] It embodies a range of from 0.02 M.V. to 50 M.V., with interchangeable scales for fitting over the fine rheostat adjustment so as to read directly in temperature for any given range of 5 millivolts. Two such scales were procured for the instrument covering ranges from 1,150 to 1,450 deg. C. and 1,450 to 1,750 deg. C., with appropriate settings of the coarse rheostat. The Negretti & Zambra potentiometer is of the mirror and spotlight galvanometer type with two 2-volt "jelly" type accumulators—one for balancing and checking against the standard cell and the other for supplying the current for the spotlight.

The other potentiometer was by the Cambridge Instrument Company, Limited (Fig 1a). It has two ranges from 0.01 M.V. to 20 M.V., and the other from 0.05 M.V. to 100 M.V.; it can therefore be used with rare metal or base metal couples with a full range of temperatures. This potentiometer is of the pointer galvanometer type, with two dry batteries for checking against the standard cell. This firm makes a special potentiometer for measuring molten metal temperatures, but it was thought that the uses of this instrument were somewhat limited, and it was decided to use the general purpose type. Both the Negretti & Zambra and the Cambridge instruments are in stout wooden cases, making them very suitable for use in the foundry, and apart from being robust they can be operated on any reasonably flat surface.

Method Employed

In the interests of economy it was decided to make the thermocouples in the research laboratory. No

*A Paper read by Mr. A. R. Parkes before the Birmingham, Coventry and West Midlands branch of the Institute of British Foundrymen.

Temperature Measurement

difficulty was encountered in making these couples or in standardising them; the method employed is given in complete detail.

For the immersion thermocouple it was decided to use a modified version of the type developed for high-frequency steel furnaces, and constructed substantially, as shown in Figs. 2, 3, 4, 4a. This model has a telescopic outer sheath of steel tube to accommodate variations in the length of the rare metal wires. On one end of the outer steel tube is welded a standard drill chuck with the taper shank removed. In this chuck the silica tube 5 mm. outside dia. by approximately 6 in. long by 3 mm. bore, with

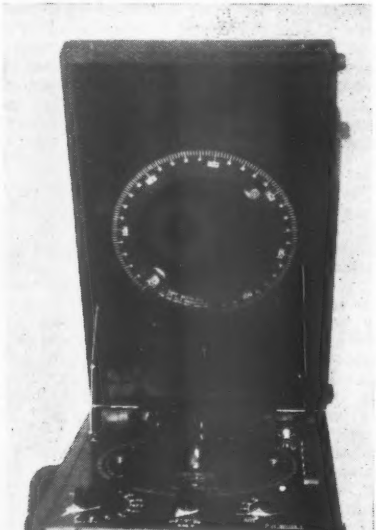

FIG. 1.—POTENTIOMETER BY NEGRETTI.

one closed end, is inserted. It is this silica tube which is actually immersed in the molten metal. The time for each immersion is about 15 sec., and as each sheath, even with care, will withstand only three to fo immersions before replacement, it is essential that so means for quick replacement of the sheath be adopte

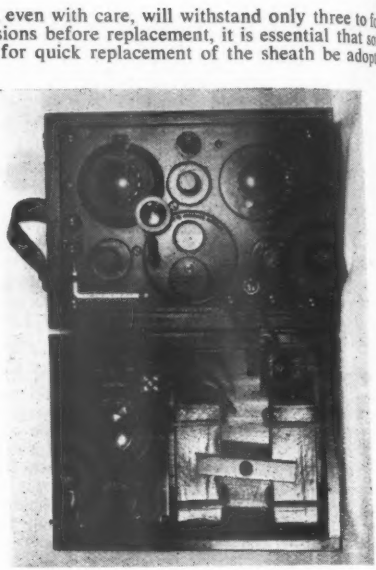

FIG. 1A.—POTENTIOMETER BY THE CAMBRIDGE INSTRUMENT COMPANY, LIMITED.

and the drill chuck method outlined above is quite satisfactory.

In the thermocouple developed by the British Cast Iron Research Association[4] the outer steel sheath terminates in a cylindrical graphite bush which is a "push fit" on to the steel tube. The rare metal wires which project some 5 in. through the graphite bush have as an outer protection a closed end silica sheath of the type mentioned above. This, too, is made a push-in fit to the graphite bush to facilitate quick replacement.

Assembling the Couple

The rare metal couple wires—standard platinum and platinum—13 per cent. rhodium, were chosen 0.5 mm. dia. to give adequate robustness for foundry conditions. It is possible to use wires of half this thickness, and an initial saving in the cost of the couple wire is thus secured, though at the expense of some of the strength. Rigidity of the wire also has to be considered when silica sheath replacements are being made. The steps in the assembly of the couple were as follow:—

(*a*) *Annealing the wires.*—When the rare metal couple wires were purchased they were in the "hard-drawn" condition and hard and brittle. The alloy wire is always the stiffer of the two and this distinction persists after annealing and serves as a means of

identification. Annealing consists of raising the wire to a bright red heat 900 to 1,000 deg. C. and cooling fairly slowly (over 3 to 5 min.). The operation can be conveniently carried out by passing a heavy electric current through the wire using mains supply and a suitable rheostat. Where a platinum wound laboratory tube furnace is available tappings can be quite simply taken off for annealing the wire, adjusting the current or the voltage as required.

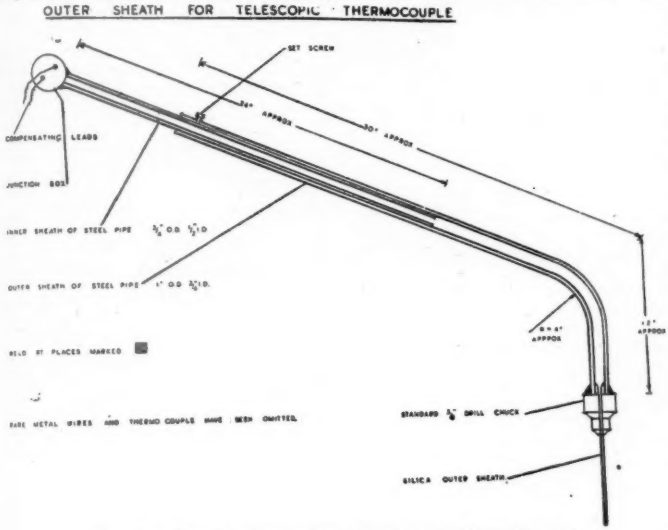

FIG. 2.—OUTER SHEATH FOR TELESCOPIC THERMOCOUPLE.

(*b*) *Insulation of wires.*—For this purpose two types of silica insulators were used, twin bore insulators taking the two wires side by side, used for 10 in. of the couple nearest the hot junction, and single bore insulators which cover the rest of the wires to the junction box at the other end of the steel sheath. The insulators were purchased in 12-in. lengths and broken into convenient lengths of 1 to 3 in. to give some flexibility to the wires. Where the single bore tubing was used, care was taken to stagger the joints to prevent possibility of "shorting" between bare wires at the joints. With the twin bore insulators the pieces were closed up tightly one to the other to prevent twisting and bending, which might result in cutting of the wires or "shorting" from one to the other.

(*c*) *Formation of the hot junction.*—This was made by twisting the ends of the wires together for about ¼ in. length. No welding was used. After being used in hot metal for a number of immersions it was found advisable to clip off the hot junction and make a fresh one. By this means the accuracy of the readings was retained as compared with a standard couple. The purpose of the telescopic outer sheath was to accommodate these periodic shortenings of the rare metal wires, without radical adjustment of the thermocouple set up. If required, new lengths of wires can be joined to old, fusing the two ends together in an oxy-coal gas blowlamp flame. Some skill is necessary in this latter operation to ensure a completely fused joint without undue thickening of the wire such as would prevent the easy fitting of the silica insulators. Table I gives details of the thermocouple parts.

(*d*) *Assembly.*—After the wires were completely insulated they were led into the steel sheaths leaving approximately 5 in. projecting from the chuck and terminating in the hot junction and the other ends connected to the terminals of the junction box. The closed end silica sheath was slipped over the "hot-junction" and fixed in the chuck using light "finger tightness" only.

The terminals of the junction box (platinum lead negative polarity and alloy wire positive polarity) were then connected to the potentiometer by means of flexible asbestos braided compensating leads 15 ft. long and the pyrometer was ready for use.

Cold Junction

In the foregoing account no mention has been made of the "cold junction." This is because for the method used by the Authors the "cold junction" was

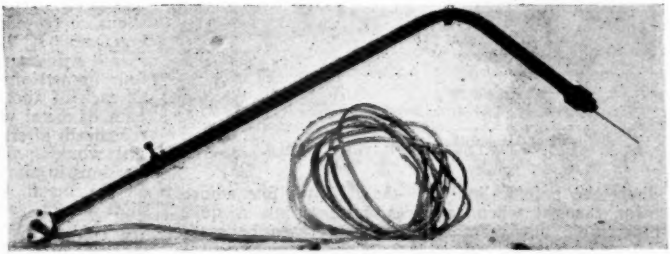

FIG. 3.—GENERAL APPEARANCE OF THE TELESCOPIC THERMOCOUPLE.

Temperature Measurement

considered as transferred to the potentiometer where a thermometer fixed to the instrument gave the room temperature. This value, converted into millivolts E.M.F. and added to the hot junction E.M.F., gives the necessary correction for the cold-junction temperature. In the account published by the British Cast Iron Research Association[4] a description is given of a method of introducing a "constant cold junction" by the inclusion of the "Thermos" flask type of cold junction in the electrical circuit. This method, however, still involves the use of a correction value each time a reading is taken. The thermostatically sealed cold junction is of advantage when the apparatus is being used under conditions of rapidly changing cold-junction temperatures.

The thermocouple after assembly was checked against a standard couple in a laboratory furnace in the following manner. The standard couple was the laboratory pattern made by the Cambridge Instrument Company, Limited. The two couples were placed side by side projecting equally into the laboratory tube furnace, with their ends as close together as possible and both touching the hot surface of the tube. Time was allowed for both to attain equilibrium temperature and then four sets of readings were taken. The Negretti & Zambra potentiometer and the Cambridge potentiometer were used alternately to measure the E.M.F. produced. Results are shown in Table II.

It will be seen by the results shown in Table II that the couple made up in the manner described compares within reasonable experimental error with the standard proprietory couple, the maximum variation being ± 2 deg. C. It will also be seen that the two types of potentiometer check closely one to the other. The maximum variation was again ± 2 deg. C. Considering the fact that readings were taken rapidly, the variations in temperature are no more than would be covered by experimental errors incidental to the operation of the instruments.

With the quick-reading potentiometer it is easier to

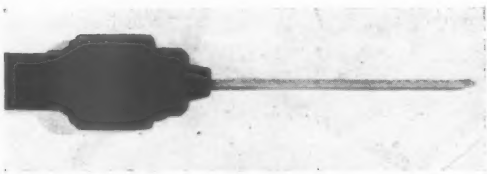

FIG. 4.—CLOSE-UP OF THE COUPLE.

direct the pointer line with the millivolt fine adjustment rheostat when taking a reading, but a quite measurable movement of the rheostat can be made before substantial movement of the pointer away from zero line can be detected. This may lead to a maximum error in reading of approximately 0.04 millivolts, equivalent to about 3 deg. C. with a Pt-Pt-Rd couple at about 1,200 deg. C.

Obtaining Final Balance

On the other hand, with the standard laboratory type of potentiometer it is more difficult to direct the pointer of the galvanometer with rheostat adjustments because of oscillations. Final balance can, however, be obtained very accurately, as the instrument is very sensitive to small rheostat adjustments (of the order of 0.005 M.V. equivalent to about 0.3 deg. C. with a rare metal couple at 1,200 deg. C.

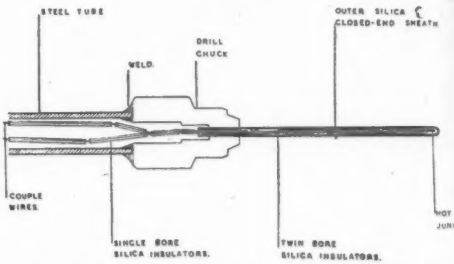

FIG. 4A.—IMMERSION THERMOCOUPLE—SECTION SHOWING CHUCK ASSEMBLY AND COUPLE INSULATION.

While the standard laboratory potentiometer is slightly more accurate, the length of time taken to obtain a reading is detrimental to the life of the sheath, whereas the possible error of the quick-reading potentiometer is not sufficient to cause any anxiety and is more than offset by the speed at which a reading can be obtained.

The next step was to test the couple in the foundry (*see* Fig. 5). Here it was found to be satisfactory in every way. A steady potential was obtained some 5 to 10 sec. after immersing the silica outer sheath containing the hot junction to a depth of 2 to 3 in. into the molten metal. Immersions could be made in any fairly deep metal reservoir, such as cupola tip-up spout, large ladle, hand ladle, feeding heads of castings, etc. It was found that the silica closed end sheath was normally capable of withstanding two to four immersions in molten metal at about 1,450 deg. C. each of about 15 sec. duration. Provided that the bath of metal was efficiently skimmed and very clean, the sheath after 15 sec. immersion came out unscathed, and would probably have withstood up to 10 immersions in similar metal. The thinnest of slag films on the metal, however, was sufficient to attack the silica sheath very rapidly, and so the slag point on the sheath was examined very carefully as routine practice after each immersion. It was obviously better practice to change the sheath frequently than

to risk damage to the couple wires. No difficulty was normally encountered in making silica sheath replacements, about 1 min. being the time required for this operation. Most of the "casualties" with the silica sheaths were caused by accidental breakage. These accidents sometimes resulted in splintering of the twin-bore silica inner sheaths, which then hindered the changing of the outer sheaths. To minimise the possibility of accidental damage to the silica sheaths in transit about the foundry, a protective steel tube was made to fit loosely over the end of the chuck so as to shield the silica tubes. This protective tube was then removed prior to making immersions.

FIG. 5.—IMMERSION PYROMETER IN USE.

Procedure of Taking Readings

Using the quick-reading potentiometer readings could be taken from the couple in 10 to 15 sec. from the time of immersion. The procedure was as follows:

(*a*) Standardisation. This involved setting the slide at zero and then balancing the E.M.F. from the accumulator against that from the standard cell.

(*b*) Setting of the rheostats to the approximate value of the E.M.F. expected for the temperature to be read, especially in respect of the coarse adjustment. For example, if a temperature in the region of 1,400 deg. C. was expected, the coarse rheostat was set beforehand at 12 M.V. and the fine rheostat at about 4.00 M.V., making a total of 16 M.V., which was roughly equivalent to 1,400 deg. C.

(*c*) Immersion of the couple.

(*d*) About 5 sec. after immersion the pointer light of the galvanometer was brought roughly to the zero setting of the slide by adjusting the rheostat with the galvanometer switch in the centre position (*i.e.*, restricted sensitivity).

(*e*) After about 8 to 10 sec. immersion the galvanometer switch was moved over to the "on" position (maximum sensitivity) and final balance obtained by adjusting the "fine" rheostat to bring the pointer light to zero.

(*f*) If there was sufficient range in the "fine" adjustment rheostat, the "coarse" rheostat was moved to an appropriate higher or lower setting and balancing recommenced.

Direct Reading Temperature Scales

It was found that the direct reading temperature scales, mentioned earlier, for superimposing on the "fine" rheostat so as to read in temperature deg. C. instead of millivolts, were not so helpful for molten Meehanite temperatures as was expected. This was for two reasons. First, the scales were calibrated for a fixed cold-junction temperature of 16 deg. C., and while this was sufficiently accurate a method for comparative temperature readings, a correction for actual cold junction temperature had to be introduced to give absolute results. When the room temperature

TABLE I.—*Thermocouple Maintenance Spares.*

Item.	Description.	Suppliers.
1. Platinum wire 2. Platinum 13 per cent. rhodium wire	0.5 mm. diameter (50 ft. = 2½ oz. approx.) 0.5 mm. diameter (50 ft. = 2½ oz. approx.)	Johnson, Matthey. Sheffield Smelting Works.
3. Silica closed end sheaths	4½ in. long × 7 mm. O.D. × 1 mm. wall 6 in. long × 5 mm. O.D. × 1 mm. wall 9 in. long × 5 mm. O.D. × 1 mm. wall 12 in. long × 5 mm. O.D. × 1 mm. wall	Amalgams, Limited. Thermal Syndicate.
4. Silica twin bore wire insulators	2.5 mm. major axis 1.0 mm. minor axis 0.7 mm. bores } in 12 in. lengths	Amalgams, Limited. Thermal Syndicate.
5. Single bore wire insulators	*Silica*: 12 in. long × 2 mm. O.D. × 0.7 mm. bore *Aluminous porcelain*: *H* Patt. T. 357 3½ in. long × 1/16 in. O.D. × 1 mm. bore *Recrystallised alumina RR.* Patt. T. 357 3½ in. long × 1/16 in. O.D. × 1 mm. bore	Amalgams, Limited. Thermal Syndicate. Morgan Crucible Company.
6. Compensating leads	Prepared lengths, flexible asbestos braided leads, ends bound and soldered solid for 2 in.	Cambridge Instrument Company.

Temperature Measurement

was actually 21 deg. C. the error introduced by reading direct from the scales was 2 to 3 deg. C. at 1,150 deg. C. Secondly, it was rather unfortunate that the scale ranges were 1,150 to 1,450 deg. C. and 1,450 to 1,750 deg. C., corresponding to coarse rheostat settings of 12 and 16 M.V. respectively, while molten metal temperatures often lie round about 1,450 deg. C., that is, midway between the two ranges. This meant that if the lower scale was fitted to the instrument and the temperature of the metal exceeded 1,450 deg. C., the coarse adjustment rheostat had to be advanced to the next higher setting (from 12 M.V. setting to 16 M.V. setting), and balancing of the E.M.F. could proceed by using the fine rheostat, there being no time to change the scale. The actual temperature could be then obtained afterwards by noting the false reading in deg. C. and then superimposing the second scale loosely over the first and transferring the reading at the appropriate point. This method was rather cumbersome, and so for general purposes at the 1,450 deg. C. range the use of the direct scales was discontinued.

A conversion chart was drawn up covering millivolt to temperature conversion for Pt.-13 per cent. Pt. Rd. couples from 1,000 to 1,627 deg. C. by 3 deg. intervals with appropriate cold junction corrections from 15 to 29 deg. C. by 1 deg. C. intervals. This was found extremely useful, as readings to 1 deg. C. could be converted at a glance. Typical readings obtained under actual foundry conditions are listed in Tables III and IV.

Table IV shows readings taken from a 10-cwt. ladle of molten cast iron from the time of tapping from the cupola up to the point where the metal began to solidify in the pouring basin of the casting, and serves as an illustration of the mobility and usefulness of the instrument. The instrument was first placed near the cupola and a reading taken from the metal in the tip-up spout as it was being delivered into a 10-cwt. ladle. A further "dip" was made in the same ladle of metal after wedge test had been poured (and the slag raked off), using a new silica sheath on the couple. Then, when the ladle of metal was taken to the moulding bay, the pyrometer was taken along and a "dip" was made in the metal as it was being poured. Finally, just as the metal in the feeding head of the casting was beginning to solidify, a last immersion was made. All these tests were made with the quick-reading potentiometer.

The standard laboratory potentiometer was not found by the Authors to be so convenient for molten metal temperature readings. The reason was that the field of view of the pointer was very limited, and when a "dip" was made the pointer swung rapidly out of the field of vision. Then, as the rheostats were quickly adjusted to "bring the pointer back," it very often overshot the zero, and went out of view on the other side of the scale. This sort of oscillation was very difficult to control within the 15 sec. time allowable for a reading. Were it possible to extend the time of immersion to 25 to 30 sec., then no doubt a very accurate reading could have been obtained. This is not in any way intended as a criticism of the type or make of this potentiometer, but merely the reason why it was elected to use the quick-reading potentiometer for these tests.

The results obtained in the foundry have shown that it is possible to obtain accurate temperature readings of molten metal with equipment which can be made up in any laboratory at an economical cost.

The equipment described for measuring E.M.F. was, as previously stated, used solely because of its accuracy, and to enable conclusions to be reached as to the effectiveness of an immersion thermocouple. For general use in the foundry a direct reading millivolt meter type of recording instrument with automatic cold-junction compensation is used. This is quite fast, and readings can be obtained in about 10 sec. An advantage of using this type of measuring instrument is that only one operator is

TABLE II.—*Results of Laboratory Check Tests on Immersion Thermocouple and Potentiometers. Four Sets of Readings at Five-minute Intervals.*

	Combination.		E.M.F. Millivolts.	Cold Junction.		Corrected E.M.F. Value.	Temperature. Deg. C.
	Potentiometer.	Couple.		Deg. C.	Value M.Vs.		
1	Cambridge	Standard ..	12.09	28	+0.158	12.248	1,133
2	N. & Z.	Standard ..	12.14	31	+0.176	12.316	1,138
3	Cambridge	Immersion ..	12.12	28	+0.158	12.278	1,135
4	N. & Z.	Immersion ..	12.13	31	+0.176	12.306	1,137
1	Cambridge	Standard ..	12.15	28	+0.158	12.308	1,137
2	N. & Z.	Standard ..	12.16	31	+0.176	12.336	1,139
3	Cambridge	Immersion ..	12.18	28	+0.158	12.338	1,139
4	N. & Z.	Immersion ..	12.16	31	+0.176	12.336	1,139
1	Cambridge	Standard ..	12.175	28	+0.158	12.333	1,139
2	N. & Z.	Standard ..	12.15	31	+0.176	12.326	1,138
3	Cambridge	Immersion ..	12.225	28	+0.158	12.383	1,143
4	N. & Z.	Immersion ..	12.20	31	+0.176	12.376	1,142
1	Cambridge	Standard ..	12.235	29	+0.164	12.399	1,144
2	N. & Z.	Standard ..	12.26	31	+0.176	12.436	1,147
3	Cambridge	Immersion ..	12.27	29	+0.164	12.434	1,146
4	N. & Z.	Immersion ..	12.28	31	+0.176	12.456	1,148

necessary. There is no reason why automatic recorders should not be used providing that such instruments are checked periodically by means of a potentiometer.

Necessity for Temperature Control

Of the necessity for temperature control there is no doubt, and the method outlined is one means of obtaining accurate measurement of molten metal temperature. The Authors have recorded their experiences in the hope that the information will be of interest and help to those who contemplate this extension of process control in their foundries.

In conclusion, the Authors wish to record their thanks to John Harper & Company, Limited, and John Harper (Meehanite), Limited, for permission to present this Paper and to draw upon experience gained in their service.

BIBLIOGRAPHY

1 Second report of the Liquid Steel Temperature Sub-committee of Iron and Steel Institute, 1939. Special Report No. 25.

2 Third report of the Liquid Steel Temperature Sub-committee of Iron and Steel Institute, 1942. Journal of the Iron and Steel Institute, No. 1.

3 THE FOUNDRY TRADE JOURNAL, Aug. 13, 1943, and Oct. 21, 1943. "Meeting the Raw Materials Supply Position in Grey Iron Foundries."

4 Publication E.4. "An immersion Thermocouple for Liquid Cast-iron Temperature Determination." British Cast Iron Research Association. October, 1944.

5 Extract from the "Engineer," Feb., 1942. "Developments in Electrical and Optical Instruments."

Vote of Thanks

Proposing a vote of thanks to Mr. Parkes, MR. A. TIPPER described the Paper as of the type from which younger members could derive real benefit. The branch, he said, was indebted to firms for allowing members of their staffs to give details of experiments and experiences. It would be interesting to know how the method outlined compared with readings taken with the optical pyrometer. Further, was it advisable to make use of these instruments in the laboratory, and for day-to-day measurements in the foundry use something simpler and more easily applied?

DR. H. T. ANGUS, who seconded the proposition, said he thought the risk which people imagined was involved in using sensitive instruments in the foundry was rather over-estimated. If there were a mishap they were apt to overlook the fact that platinum commanded a very good price as scrap. The value of instruments of this sort lay in the use which was made of them in controlling quality over the whole run of the foundry's output. The value of a single determination was comparatively small, but that of several hundreds was extremely great. The cost of the instrument in its simplest form was not great, and if used systematically it gave a great deal of information. In the case of the mechanised foundry it was of particular value. The cost of a determination in a grey-iron foundry would probably not exceed 1s.

DISCUSSION

MR. A. DUNLOP did not think there was any need to be afraid about the fragility of the instrument. When the metal temperature was high—1,500 deg. or so—it was very important to ensure that the sheath was perpendicular, because the silica became quite plastic and would bend. Once the sheath bent they would not get it off without breaking the inner insulating tubing.

MR. PARKES, referring to some of the points mentioned, said that in the case of the disappearing filament type of optical pyrometer, as used separately or in conjunction with the dip type of couple, they found that the disappearing filament type was usually of the order of 50 deg. below that of the dip reading in the same metal. The idea of using one as a rapid method, while checking frequently by the dip method, was quite satisfactory so long as the limitations of the optical instrument were borne in mind.

TABLE III.—*Immersion Pyrometer Results—Meehanite Metal.*

Immersion Number.	E.M.F. Millivolts.	Cold Junction.		Corrected E.M.F. Value.	Temperature Deg. C.	Time of Immersion.
		Deg. C.	Value M.Vs.			
1	16.33	20	+0.110	16.440	1,435	15 secs.
2	15.92	20	+0.110	16.030	1,405	13 secs.
3	16.53	20	+0.110	16.640	1,447	10 secs.
4	16.51	19	+0.104	16.614	1,445	17 secs.
5	15.99	20	+0.110	16.100	1,411	13 secs.
6	16.66	18	+0.098	16.758	1,456	15 secs.

TABLE IV.—*Immersion Pyrometer Results—Meehanite Metal.*

No.	Time.	Location.	E.M.F. Millivolts.	Cold Junction.		Corrected E.M.F. Value.	Temperature Deg. C.
				Deg. C.	Value in M.Vs.		
1	3.45 p.m.	Tip-up spout at cupola ..	17.70	20	0.110	17.810	1,531
Closed end silica sheath renewed.							
2	3.48 p.m.	In ladle after raking slag off	16.32	20	0.110	16.430	1,435
3	3.52 p.m.	In ladle during pouring ..	15.54	21	0.116	15.656	1,378
4	3.58 p.m.	In feeding head of casting. Skin beginning to form	13.91	21	0.116	14.026	1,262

Temperature Measurement

As they did not normally deal with the high temperatures which Mr. Dunlop had been measuring, the difficulty of the sheath bending was not so pronounced.

MR. PARKES said that by taking the recordings they were extending their method of control. To make a temperature reading was an additional investigation into why a certain casting might be scrap or might be a good casting. When they had sufficient information, gathered in that manner, they were able to set limits on their readings and decide whether certain metal was suitable for the class of casting, or whether it should be scrapped or used for a type which was not so exacting. That position could only be arrived at after a large number of observations had been obtained on a certain class of casting. When they knew the temperature was right and, at the end, a casting had to be scrapped, if someone said "Yes, but the metal was not hot enough," they were able to scotch the snake.

A question having been raised as to the possibility of taking the temperature of a bath of molten metal before it is tapped, Mr. Parkes said the matter of taking the temperature of metals inside the furnace had been adequately dealt with by the publication of researches carried out by Dr. Schofield, and his development of the dip pyrometer of the type he (the lecturer) had mentioned, but adapted for use in open-hearth and similar bath-type furnaces. Couples as long as 20 ft. had been used on an undercarriage with equal success, so that the temperature of a bath of molten metal could be accurately ascertained before it was tapped.

JOINT COMMITTEE ON METALLURGICAL EDUCATION

The importance of scientific and technical education —and especially education in metallurgy—to the iron and steel and non-ferrous metals industries is generally acknowledged. It is, therefore, satisfactory to note the recent formation of a Joint Committee on Metallurgical Education by the Councils of the five leading national metallurgical institutes—the Iron and Steel Institute, the Institution of Mining and Metallurgy, the Institute of British Foundrymen, the Institute of Metals and the Institution of Metallurgists.

The Committee will advise and co-ordinate the policy of the Councils on all matters concerning education in metallurgy, draw attention to the requirements of industry, advise those responsible for teaching and assist parents and masters in guiding boys in the choice of future careers. It will be an important part of the duties of this new Committee to supplement the work of the Committee on National Certificates in Metallurgy and the activities of the Councils of the participating institutions in raising the status and defining the qualifications of metallurgists. Inquiries will be welcomed and should be addressed to the Secretary, 4, Grosvenor Gardens, London, S.W.1.

ROYAL STATISTICAL SOCIETY

INDUSTRIAL APPLICATIONS SECTION

Before the war there existed in the Royal Statistical Society an industrial and agricultural research section. The activities of this section were suspended at the outbreak of hostilities, but the Society has decided that the section shall be reconstituted in the form of two separate sections, a research section and an industrial applications section. The latter has grown out of the successful activities of the informally constituted industrial applications group which held 17 discussion meetings in London from 1942-1945. These catered for the greatly increased interest in the application of statistical methods in industrial problems, particularly those associated with the control of quality of production. The activities of the group have provided a common meeting ground for statisticians and engineers and the organisation of the industrial applications section will ensure a permanent basis for discussion.

The section is concerned with the application of statistical technique in industrial research, development, and manufacture, including inspection. It is organised in local groups, which may be formed wherever sufficient support is forthcoming. Groups have already been formed in Birmingham, London, and Sheffield, and one is in the process of formation in the North-East Coast area. Membership of the section is open to all interested persons who are approved by the section committee. An annual subscription of 10s. is payable by non-fellows direct to the Society, which in turn finances the local groups. Further information may be obtained from the Assistant Secretary, Royal Statistical Society, 4, Portugal Street, London, W.C.2.

CAREERS IN IRON AND STEEL

Dorman, Long & Company, Limited, Middlesbrough, have produced an extremely businesslike pamphlet, which sets forth the training scheme they have adopted for entrants to their establishments. The number of trades and professions indicated is rather bewildering and the presentation of the subject matter does not help either a boy or his parent to make up their minds as to whether coal-heaving or chemistry is the line to be chosen. The "family tree" diagrams are excellent, as they show how any entrant, no matter in what grade he starts, can get to the top of the "tree."

A MANSION HOUSE at Skelmorlie, Ayrshire, has been given to the employees of Colvilles, Limited, by Sir John Craig, chairman and managing director of the firm. The house is to be dedicated as a war memorial to employees, and used as a convalescent home for the workers of the Colville group of steel companies and its associated concerns. The directors of Colvilles, Limited, are to make a regular financial contribution towards the maintenance and upkeep of the house, which is to be known as the Craig War Memorial Home.

THE APPLICATION OF ETHYL SILICATE TO FOUNDRY PRACTICE

By CLIFFORD SHAW, B.Sc.

Discussion on a Paper read before a joint meeting of the London branch of the Institute of British Foundrymen and the London local section of the Institute of Metals, held at the Royal Institution. Mr. A. J. Murphy, M.Sc., president of the London branch of the I.B.F., who presided, was accompanied by Mr. G. L. Bailey, M.Sc., chairman of the London local section of the Institute of Metals. The Paper was printed in our issue of January 10.

The CHAIRMAN (Mr. A. J. Murphy, M.Sc.), on behalf of the Institute of British Foundrymen, who were the hosts, extended a warm welcome to the guests, the members of the Institute of Metals. It was a particular pleasure to welcome them, he said, in the historic lecture hall of the Royal Institution. He believed it was due to the energetic offices of Mr. Clifford Shaw and Mr. R. Arnold Wilson that they were able to enjoy the privilege of meeting there. Recalling that it had been the practice of the two bodies to meet together annually for quite a number of years, a practice which had had to be discontinued during the greater part of the war, he said the last joint meeting was held in 1940, when the London local section of the Institute of Metals were the hosts of the London branch of the Institute of British Foundrymen. It was indeed a pleasure to resume the joint meetings and to be able to welcome so many members of the Institute of Metals.

Introducing the lecturer, he said Mr. Clifford Shaw was a principal of Messrs. Smith & Shaw, who were consultants on silicon compounds. The occasion was the first on which Mr. Shaw had addressed any gathering of a metallurgical or foundry technical character. Many had heard of ethyl silicate as applied to certain aspects of foundry practice, but the whole subject had been surrounded by an atmosphere of very great secrecy, no doubt due to the abnormal times through which we had been passing, and they looked forward with particular pleasure to hearing an authentic account by an authority so well recognised as was Mr. Shaw. Apparently it was not Mr. Shaw's intention to go very deeply into foundry technique; he held the view that foundrymen should be able to look after themselves in that respect. But he would describe the characteristics of ethyl silicate as a new material with interesting possibilities of application to various aspects of moulding.

DISCUSSION

The CHAIRMAN said it had been shown how, by the use of the new material, one could obtain castings of improved dimensional accuracy and appearance, and could improve the permanence of refractory moulds. One was impressed by the modest way in which Mr. Clifford Shaw had referred to the part which he and Mr. Noel Shaw had played in those developments.

MR. F. L. LEVY commented that no mention had been made of permeability or venting of the moulds, which was a very important factor.

MR. CLIFFORD SHAW replied that the silica structure of the body of the mould itself was always porous; but vents were required, of course, as in normal practice.

MR. LEVY asked if the porosity and permeability of the silica moulds was similar to that of ordinary foundry green sand.

The AUTHOR said the porosity was 12 to 14 per cent., which meant 12 to 14 per cent. voids. He did not know much about sands.

Permeability of Silicon Esters

MR. E. W. HARDING (International Meehanite Metal Company, Limited), asked whether the use of ethyl silicate moulds was confined to the casting of light metals and low-melting point alloys, or whether they could be used for steel and cast iron. He had in mind particularly the low permeability of the material.

MR. C. SHAW replied that the moulds could be used quite nicely for cast iron. But in the case of the high-temperature steels, at temperatures of 1,550 deg. or thereabouts, of considerable mass, the pouring and gating was more difficult, and in such cases they had not been able to use the moulds a second time. If the quantity of such metal were considerable there was formed a certain slag oxide which affected the mould face; but one was able to get a good casting from it. The material of the moulds was a bad conductor of heat, so that the moulds held the heat for a long time.

MR. HARDING said it seemed fairly obvious that an ethyl silicate mould had not the permeability of a green-sand mould. He had had an opportunity to try a piece of the material which Mr. Shaw had kindly given him, and he had found that it did not work with cast iron, but had blown badly; perhaps that was because the work was not done properly.

MR. C. SHAW reiterated that he had used the moulds for cast iron.

MR. V. ELKINGTON (Dover Foundry Company, Limited), said he had gathered that there were no gas-forming materials or bodies in the matrix of the ethyl silicate mould material; in other words, there being no mould gases, one had only to deal with the gas which was in solution in the metal.

MR. CLIFFORD SHAW agreed.

MR. ELKINGTON asked, therefore, whether the permeability of the mould material after being baked was sufficient to allow that gas to escape.

The AUTHOR replied that it was.

Cores from the New Material

MR. J. F. CHAMBERS (Ealing Park Foundry, Limited) was concerned with the making of very fragile cores, so fragile that, with the normal foundry bonding

The Application of Ethyl Silicate

materials, it was almost impossible to use them for castings. He asked whether the ethyl silicate material could be used for that purpose, and would provide a bond sufficient to produce cores strong enough to be used, with careful handling.

MR. CLIFFORD SHAW replied that he would be very happy to make a core of the kind referred to, using the ethyl silicate material.

MR. CHAMBERS said he looked forward to trying out the material.

Possibility of Gels from Sodium Silicate

MR. P. D. LIDDIARD (Glacier Metal Company, Limited), after congratulating Mr. Shaw on the concise and interesting way in which he had presented his subject, discussed the material from the chemical rather than the foundry point of view. Mr. Shaw appeared to be aiming at a very fine form of colloidal silica, in a gel which would bind the other refractory material together. One felt that it might be possible, however, to arrive at such a result with a less expensive and more easily produced material, the raw material being already available. He had in mind the straight sodium silicates, which contained a higher proportion of silica to the Na_2O molecule. When reacted with acid, they would give the same colloidal silica and gel formation that was obtained with the more expensive esters. Those materials were directly miscible with water, and there was not the difficulty of having to use alcohol; and instead of alcohol coming off in the hydrolysis, there would be water in its place.

MR. CLIFFORD SHAW said the fact that sodium silicate was cheap had not escaped his notice; but Mr. Noel Shaw and himself had tried to do various things with sodium silicate, and he could give the assurance that it was by no means as simple as it sounded. In the first place, water could not be eliminated so easily as alcohol. Further, there was not the same gel formation in the plastic stage that could be obtained with ethyl silicate; one did not obtain a strong material which, without cracking and changing size and shape, would go through all the stages from slurry to hard refractory. Whilst he would not say that it was impossible to do those things, he was not aware of anyone who had done them, and he would certainly not regard that line of investigation as being very promising.

MR. H. G. WARRINGTON (Richmond) said he had gathered that, whereas in the normal procedure for using the silicon ester one had very carefully to control pH value, and so on, in the new technique an addition was made to the silicon ester and it was not necessary to exercise such great care. If that were so, he asked what addition was made.

MR. C. SHAW replied that it was one of a very restricted number of condensing agents.

S.O.S.

MR. BERGH, who was concerned, not as a foundryman, but as one who had to use stainless steel castings in food plant, where the surface finish of the castings was always an important item, said that in some cases the small castings had to be highly polished; and the polishing costs were high. Some time ago he had had occasion to visit Mr. Shaw's laboratory; Mr. Shaw had shown him two small stainless steel castings made by this process, and which had a beautiful finish. They were experimental jobs, and Mr. Bergh was informed that nobody was producing such castings regularly and commercially. Therefore, he exhorted foundrymen to hurry and produce such castings, for he wanted them.

Permanent Moulds

DR. J. C. CHASTON, dealing with the question as to why sodium silicate had not been used previously, said he understood the reason was the presence of the sodium salts, which would be left behind after precipitation of the silica. It seemed to him that the main use for ethyl silicate in foundry practice would be in permanent moulds, to take the place of steel moulds for gravity die casting, and so on. It might be applied to such uses cheaply; he asked if that had been done, for it seemed to be well worth while. Arising out of that, he said the low heat conductivity of the material might be a disadvantage. Therefore, he asked whether anyone had tried using steel chills behind the facing. Finally, he asked whether ethyl silicate moulds, if they became worn after a few castings had been made, could be patched.

MR. CLIFFORD SHAW replied that certainly it was possible to patch the moulds; indeed, it was quite easy to do so, and he had examples of patched moulds in the laboratory. The insertion of steel chills behind the facing was also quite easy; the chills could be put in anywhere, and the fact that there was no noticeable change of dimension of the moulds meant that the chills would remain where they were put. He agreed entirely that one of the most interesting fields of application of ethyl silicate was that of permanent and semi-permanent moulds; although he had done nothing in the way of making gravity die castings, it was just a question of making a really hard mould. Again, however, for dealing with massive castings in high-melting point metals, it would probably give rise to trouble. But we were not yet at the end of the story; there were other esters coming along in due course which would give higher refractory qualities and very greatly increased strength.

DR. CHASTON asked if that meant there were other esters, besides silicon ester.

MR. SHAW said there were other esters.

MR. BRANDON asked what would be a good acceptance test, and what method Mr. Shaw would recommend for measuring viscosity.

MR. C. SHAW replied that he and his colleagues were busy on that matter and had not yet decided on a simple test. He would need notice of such a question.

MR. J. B. BOYD, recalling a statement in the Paper that the ethyl silicate moulds would withstand temperatures up to about 1,600 deg. C., asked if they would withstand the casting of a bronze alloy containing a fair amount of lead, which had searching qualities.

MR. C. SHAW said he could see no reason why not; but he did not know sufficient about the properties of lead bronze to be able to give a definite answer. The only thing to do was to try it and see.

Vote of Thanks

MR. G. L. BAILEY, M.Sc. (chairman, London local section, Institute of Metals), returned thanks to the London branch of the Institute of British Foundrymen for the invitation to attend, and proposed the thanks of the meeting to Mr. Clifford Shaw and Mr. Noel Shaw for their Paper and demonstrations. He was to some extent alarmed by the high standard which the London branch of the Institute of British Foundrymen had set, on the resumption of the joint meetings between the two bodies; the magnificence of the lecture hall and the extremely interesting lecture had given himself and his fellow members of the London local section of the Institute of Metals something to think about when arranging the next joint meeting, at which they looked forward to returning this hospitality.

Complimenting Mr. Shaw on having given a Paper on an unusual subject, he said it was obvious that Mr. Shaw knew a good deal about the foundry behaviour of ethyl silicate; but presumably his main object was to tell foundrymen and metallurgists about the material so that they could learn more for themselves about what could be done with it. Certainly he had given them something to think about.

A matter which Mr. Shaw had not discussed, but which was of great interest to those who would be concerned with the use of the material in " bread and butter " ways, was that of price, which was obviously a very important factor to those willing to experiment with the material, and the price would depend on the demand and on the interest that was shown. He would be glad to have any guidance that Mr. Shaw could give as to the probability or otherwise of any substantial reduction of the present price of silicon ester, for that would perhaps encourage some of them in their attempts to extend its use.

Being a little disappointed in the reply to Dr. Chaston's question concerning the utilisation of the material for making semi-permanent moulds, or as an alternative to metal moulds, probably of shorter life, for die casting, Mr. Bailey pursued the matter further. He had gathered that Mr. Shaw had had experience of the repeated use of moulds made of that material for casting low-melting-point alloys. But it would be interesting to know what Mr. Shaw had meant by " low-melting-point " alloys, and what was the resistance of the ethyl silicate material to severe thermal shock such as was produced when a really high-melting-point metal was poured into it. If the mould could be detached without smashing it, was there any evidence that under those conditions the mould cracked, even though not until after the casting had become solid? Such cracking would not matter, perhaps, to the first casting, but it would matter a great deal to the second.

MR. F. HUDSON seconded the vote of thanks. Commenting on the Paper, he said he was particularly glad that not too much stress had been laid on the precision casting side of the business; the average foundryman might perhaps have lost sight of the other uses of the material, in view of the large amount of work and discussion lately on the production of castings by precision methods.

With regard to Mr. Shaw's reference to the stability and freedom from cracking of silicon ester, Mr. Hudson said he would accept the statement with a grain of salt. It seemed to him that, if any refractory were coated with a film of silica, that silica must go through certain dimensional changes during heating, and that those dimensional changes must cause some cracking or stressing in the refractory. If the process had been developed so that complete freedom from cracking could be guaranteed, then Mr. Shaw and his colleagues had gone a very long way to overcome a fault which had existed in the silicon ester which had been supplied until quite recently.

Silicosis

A matter which was causing foundrymen a very great deal of thought nowadays was that of silicosis, and, in consequence, many foundrymen were dead against the use of silicon products. In the steel industry a large amount of work had been done in an effort to get away from the use of silica. Therefore, it would be of great value if Mr. Shaw and his colleagues could hurry the development of esters so that something other than silica could be used. Finally, Mr. Hudson expressed the great interest and pleasure which the meeting had derived from the Paper.

The vote of thanks was carried with acclamation.

MR. CLIFFORD SHAW, responding, said that he and Mr. Noel Shaw were much gratified by the interest which the meeting had displayed. Replying to Mr. Bailey's question concerning the definition of low-melting-point alloys, he said there was also the factor of the mass of metal to be cast. But certainly one could say that, from cast iron temperature downwards, it was easy to cast in ethyl silicate moulds; but—leaving a loophole for the nasty things that some people might say—at temperatures above that of cast iron, when casting massive objects, one should look out for difficulties with various alloys on account of slag. The thermal shock resistance of ethyl silicate was remarkably good.

With regard to price, he had not the least hesitation in giving all the information he could. As indicated by Mr. Bailey, it would depend considerably on the extent of the use of the material. The ruling price was about 50s. per gall. American material had been introduced, but had not notably competed. But he believed that during 1946 supplies would be available at not more than 30s. per gall.; he expected it to come down to something like 15s. by the end of 1946; and thereafter, in greater or lesser time, the ultimate sort of price that would be aimed at would probably be about 10s. per gall. Of course, he could not give any guarantee. As to the cracking of the material, he was not by any means claiming that that was impossible. But he did claim that, if in the case of any specific job the foundryman experienced one or two bad shots, once the right grading, and so on, was arrived at, there would be no more cracking; once the foundryman arrived at the right balance for a job, he could go on repeating it. Mr. Shaw did not think there was anything to fear with regard to silicosis aising from the use of silcon ester. It had been used for years with completely negligible results from that point of view.

MR. NOEL SHAW commented that it might arise in connection with the recovery of moulds.

MR. CLIFFORD SHAW said that it might, but he imagined that any risk could be overcome by taking very elementary precautions.

NOTES FROM THE BRANCHES

FALKIRK SECTION.—At the December meeting of this section, held at the Temperance Café, Falkirk, with Mr. Thomas R. Goodwin in the chair, Mr. William Shaw, of Larbert, presented a Paper on "Enamelling and Protective Finishes for Cast Iron." The lecturer introduced his subject with a *resumé* of the properties of iron, both as the pure metal and as the cast alloys with which foundrymen are familiar. He stressed the importance of removing castings from the mould as soon as redness had gone, especially where these castings were destined for any of the enamelling or other finishing processes. At this point, Mr. Shaw suggested that a certain amount of carbonaceous facing was desirable in the production of enamelling castings. Thereafter, the porcelain and vitreous enamelling processes were described in detail, the various enamel compositions and functions of the constituent materials being thoroughly explained. The need for prior treatment such as annealing or burning out, and shot-blasting was stressed, together with details of each type of shot-blasting equipment. The limitations of the blast process as a cleaning medium were not lost sight of, while the folly of claying, or stopping-up large-sized cavities in casting surfaces, was condemned. The question of ground coats next occupied the speaker's attention, mention being made of the poor adhesion of a normal matt ground coat.

After summarising the results of applying a coating of enamel on a metal surface. Mr. Shaw tackled the question of galvanising and sherardising. This results in a coating of iron-zinc alloy, which is an efficient rust preventive, although the zinc coating is easily removed by abrasion, and it is less decorative than other finishes. Tinning and barffing followed, while electro-deposition of metals such as chromium, nickel, copper, zinc and cadmium received their modicum of attention. Bonderising and Parkerising were also described, from the point of view of their use as a base for subsequent finishes. In conclusion, Mr. Shaw suggested that a hot process was better than a cold process, as injurious gases are driven from the structure of the metal during the process, and in his opinion, of all the finishes described, vitreous enamelling, if properly applied, could meet all the demands of even the most critical iron-founder.

After an enlightened discussion, a hearty vote of thanks to the lecturer brought a most enjoyable evening to a close.

LONDON BRANCH.—The January meeting, held at the Charing Cross Hotel, was devoted to an informal discussion on metallurgical patents. Mr. A. J. Murphy, M.Sc., presided. The discussion was opened by a prominent member of the legal profession, who, by reference to some noteworthy court cases, pointed out the essential aspects to be set out when applying for protection. Information was forthcoming as to the present position of the omnibus licences mutually granted to each by the allied governments during the war period, as well as many other obscure points.

PUBLICATIONS RECEIVED

Control Methods for the Iron Foundry. Published by the St. Lawrence Alloys & Metals, Limited, Beauharnois, Quebec, Canada.

There is much commonsense set out in this 12-page brochure. In a set of 12 rules postulated there is a commendable omission of the negative, but in one case the word "watch" is included. The reviewer prefers the substitution of the word "control" for "watch" as being more appropriate to modern practice. Use of the chill test is strongly urged as a means of metal control. As the issuing house manufacture alloys, there is included a section on the use of silicon-manganese-zirconium, ferro-silicon, and other materials as media for the amelioration of properties. It is a worth-while publication to possess and copies may be had by writing to Canada.

Silicomanganese Alloys in Steelmaking. Published by the St. Lawrence Alloys & Metals, Limited, Beauharnois, Quebec, Canada.

This booklet describes the metallurgy and the purposes of deoxidation practices, and points out the advantages offered by deoxidation with silicomanganese alloys. Melting procedures are described for open-hearth and electric furnaces and charts are included to help to calculate alloy additions. Information is given on the company's facilities for providing metallurgical assistance to customers, and a list of "St. Lawrence" products used in foundries and steel mills is also included. Copies will be sent to our readers if they will write to Canada on their business letterheads.

Elastomeric Engineering. Published by Andre Rubber Company, Limited, Hook Rise Tolworth, Surrey.

This is from one angle a hybrid publication, as it is available for engineering executives, designers and leading draughtsmen free of charge, but for the man-in-the-street it costs a guinea. The book runs to 160 pages and is profusely illustrated. It appears that the adhesion of metal to rubber is achieved by brass plating the iron or steel and then utilising a chemical reaction between the sulphur in the rubber with the brass. It is obvious that the engineering applications of rubber bonded to metal are manifold, and readers will find inspiration from the jobs already successfully accomplished.

Birlecomedy Xmas, 1945. Issued by Birlec, Limited, Tyburn Road, Erdington, Birmingham, 24.

This is the cleverest piece of nonsense the reviewer has ever seen applied to modern scientific developments. Here the author candidly admits being "blinded by science," but very carefully manages to impress the reader that if he intends to stay in business he has simply got to readjust his ideas to modern technical developments. The reviewer specially commends this pamphlet to manufacturers of malleable-iron castings. Representing a new type of publicity, it is nothing other than brilliant.

BOLTS, NUTS, SCREWS AND RIVETS

MAXIMUM UNITED KINGDOM PRICES

New prices for bolts, nuts and rivets are in operation as the result of the Control of Bolts, Nuts, Screws, Screw Studs, Washers and Rivets (No. 9) Order, 1945, which became effective on December 31.

The prices set out below are basis prices for sales by manufacturers of the quantity shown delivered to buyer.

BLACK STEEL BOLTS, NUTS, SCREWS AND SCREW STUDS.—Hexagon round hexagon bolts and nuts to B.S. 916, 1½ in. by ½ in.—13s. 6d. per 100 units each of a bolt assembled with a nut, less 16½ per cent. for 500 units. Cut square square carriage bolts and nuts, ¼ in. by ½ in.—8s. 1d. per gross, less 42½ per cent. and 2½ per cent. for lots of 250 gross assorted sizes.

BRIGHT STEEL BOLTS AND NUTS.—Hexagon head bolts, ¼ in. by ½ in., 8s. 7d. per gross; hexagon nuts, ½ in. plain, 2s. 8d. per gross, plus 5 per cent. in each case.

BRIGHT STEEL STUDS, 1 in. by ½ in., 4s. 9d. per gross, plus 5 per cent.

STEEL BOLTS AND SET SCREWS TO B.S. 1083/1942.—FB. 106/8A 6s. 10d., FB. 108/12C 16s. 7d. per gross, plus 7½ per cent. FB. 104/8D and FS. 104/8D, 4s. 3d. per gross, plus 7½ per cent. for lots of over 10 gross.

FORGED AND HEAT-TREATED "D" QUALITY S.A.E. STEEL BOLTS AND SET SCREWS, 1 in. by ½ in., 4s. 3d. per gross, plus 7½ per cent. for lots of over 10 gross.

STEEL NUTS TO B.S. 1083/1942 GRADE "L." Plain ½ in., 10s. 3d. per gross.

STEEL BOLTS TO ADMIRALTY SCHEDULE 92 U.T.S., 30/35 tons per sq. in., 2 in. by ⅝ in., 41s. 5d. per gross, plus 3¾ per cent.

STEEL BOLTS TO ADMIRALTY SCHEDULE 92A U.T.S., 45/55 tons per sq. in., 2 in. by ⅝ in., 43s. 8d. per gross, plus 7½ per cent.

ALLOY STEEL BOLTS TO ADMIRALTY SCHEDULE 92A, 2 in. by ⅞ in., 142s. 8d. per gross.

NUTS AND STUDS TO ADMIRALTY SCHEDULE 92.—Nuts, bright, ⅝ in., 17s. 9d.; studs, 2½ in. by ⅝ in., 27s. 1d., per gross, plus 3¾ per cent.

HIGH-TENSILE STEEL STUDS.—B.S.S. 1083, Grade D, 1 in. by ½ in., 6s. 10d.; Admiralty Schedule 92A, 1 in. by ½ in., 7s. 10d., per gross, plus 7½ per cent.

AIRCRAFT BOLTS, for lots of over 10 gross of a size.—Steel, cold headed to spec. 6.A.1, 1C, 5s. 1d. per gross, less 12½ per cent. and 10 per cent.; steel, cold headed to spec. 2.A.15.Y, 1B, 8s. 9d. per gross, less 10 per cent. and 10 per cent.; steel, cold headed to drawing A.S. 1248. 5B, 9s. 11d. per gross, less 10 per cent.; steel, cold headed to drawing A.S. 1885, 1C, 5s. 1d. per gross, less 7½ per cent. and 10 per cent.; steel turned from bar to spec. 6.A.1, 1A, 8s. 4d. per gross, less 10 per cent. and 5 per cent.; steel, turned from bar to spec. 2.A.15.Y, 1A, 17s. 6d. per gross, less 10 per cent. and 5 per cent.; steel riveted, to spec. 6.A.1, 23.A, 25s. 2d. per gross, less 12½ per cent. and 10 per cent.; steel, riveted, to spec. 2.A.15.Y, 23A, 32s. 3d. per gross, less 10 per cent. and 10 per cent.; stainless steel, turned from bar to spec. 2.A.15.Z, 1A, 18s. per gross; light alloy, turned from bar to spec. A.17, 1B, 11s. 9d. per gross, less 10 per cent.; light alloy, cold headed to spec. A.17, 1B, 7s. 6d. per gross, less 15 per cent. and 10 per cent.; light alloy, cold headed to drawing A.S.1243, 4B, 8s. 2d. per gross, less 15 per cent. and 10 per cent.

AIRCRAFT NUTS.—Steel to spec. A.16Y, C.P., 2s. 8d.; steel to spec. A.16Y, E.P., 4s. 6d.; stainless steel, S.80,. plain ¼ in., 17s.; Dural, plain, ¼ in., 5s. 11d.; brass, self-finished, A.14, E.B., 3s. 3d., per gross.

AIRCRAFT SCREWS.—Steel, round head to spec. A.G.S. 245/29, ¼ in. by 6 B.A., 9½ per gross, less 12½ per cent. and 10 per cent. for lots of over 24 gross; steel, turned, round head, to spec. A.G.S. 245, 3/16 in. by 0 B.A., 9s. 6d. per gross for lots of over 24 gross; brass, round head, to spec. A.G.S. 244/29, ¼ in. by 6 B.A., 1s. 6d. per gross, less 7½ per cent. and 10 per cent. for lots of over 24 gross; brass, turned, round head, to spec. A.G.S. 244, 3/16 in. by 0 B.A., 4s. 2d. per gross for lots of 250 gross; light alloy, round head, to spec. A.G.S. 564/29, ¼ in. by 6 B.A., 2s. 10½d. per gross, less 7½ per cent. and 10 per cent. for lots of over 24 gross; "K" Monel metal, round head, to spec. A.G.S. 967/29, ¼ in. by 6 B.A., 4s. 9½d. per gross for lots of over 24 gross.

AIRCRAFT RIVETS.—Steel, snaphead, ¼ in. by ½ in., 5½d. per lb. for 4-cwt. lots.

B.A. NUTS.—Steel, plain, 4 B.A., 3s. 1d.; brass, plain, 4 B.A., 2s. 1d., per gross, less 50 per cent. for lots of 250 gross.

METAL THREAD SCREWS.—Steel, rolled thread, round head, ½ in. by 6 B.A., 1s. 2d. per gross, less 65 per cent. for lots of 50 gross assorted sizes; brass, rolled thread, round head, ½ in. by 6 B.A., 2s. 1d. per gross, less 55 per cent. for lots of 50 gross; steel, turned from bar, ½ in. by 6 B.A., round head, 4s. 4d. per gross, less 33⅓ per cent. for lots of 250 gross; brass turned from bar, ½ in. by 6 B.A., round head, 2s. 4d. per gross less 33⅓ per cent. for lots of 250 gross.

(*All the above delivered free in consignments of* £10 *and over, except Northern Ireland.*)

SET SCREWS AND CAP SCREWS, steel, socket, set ½ in. by ½ in., £1 0s. 10d. per 100, less 25 per cent.

WOOD SCREWS, steel, ¾ in. by 6 gauge, countersunk head, 1s. per goss, less 17½ per cent.; brass, ¾ in. by 6 gauge, countersunk head, 2s. 3d. per gross, less 22½ per cent., 2-cwt. or £10 lots.

HOT SPELTER GALVANISED MUSHROOM HEAD, STEEL ROOFING BOLTS AND NUTS. ¾ in. by ½ in., 2s. 5d. per gross for £5 lots.

BRIGHT STEEL GUTTER BOLTS AND NUTS, ¾ in. by ½ in., 1s. 11d. per gross for £5 lots.

RIVETS, 4 in. by ¾ in. dia. (delivered Midland area, 2-ton lots): Mild steel, £24 15s. per ton; wrought iron, £25 10s. per ton; No. 12 coopers' rivets, steel, £1 16s. 9d. per cwt. for 2-ton lots.

MR. JOHN DELMONTE, in an article in the "Iron Age," details a method of toughening plaster of paris models by impregnating the component with a synthetic resin of the furane series. "When it is desired to develop maximum impact strength glass wool added to the plaster of paris before pouring, and then subsequently cured with resin, offers a structure capable of taking much mechanical abuse."

PERSONAL

SIR FRANK NIXON has been elected a director of John Brown & Company, Limited.

MR. H. H. DAWSON has been elected a director of Ransomes, Sims & Jefferies, Limited.

MR. COLIN LESLIE FORBES has been appointed a director of Greenwood & Batley, Limited.

MAJOR CHARLES MCCLELLAND has been appointed a director of Associated British Engineering, Limited.

SIR CLIVE BAILLIEU, president of the Federation of British Industries, has been nominated for a second year of office.

SIR GEORGE E. LEON, a director of Henry Gardner & Company, Limited, resigned his seat on the board as at December 31 last.

SIR GEOFFREY D. BURTON has been released from his appointment as Director-General of Mechanical Equipment, Ministry of Supply.

MR. J. A. MILNE has been appointed chairman of J. Samuel White & Company, Limited. He will also retain his present appointment as managing director.

MR. CHARLES WOOD has retired after more than 58 years' service with the ironworks branch of Newton Chambers & Company, Limited, at Thorncliffe, Sheffield.

MR. A. CLEWS, of Hadley, Salop, is retiring after 47 years with Joseph Sankey & Sons, Limited. Mr. Clews is head of the wheel department at the Castle Works, Hadley.

LIEUT.-COL. G. P. POLLITT, one of the original directors of Imperial Chemical Industries, Limited, is retiring. He played a leading part in the creation of the first synthetic nitrogen plant at Billingham.

MR. P. C. DICKENS has relinquished his appointment as treasurer of Imperial Chemical Industries, Limited, on his retirement from the company, and has been succeeded by MR. J. L. ARMSTRONG as treasurer.

MR. WILLIAM RAWLINGS, secretary of William Doxford & Sons, Limited, shipbuilders, of Sunderland, for 10 years, has retired after 54 years' service with the firm. His successor is MR. J. C. HUGILL, chief accountant with the firm.

MR. A. E. BOWN, a fettler in the employ of the Bristol Foundry Company, has been awarded the British Empire Medal in recognition of the splendid work which he has put in during the war. He has been with the company for more than 50 years, during which time he has been absent on only two occasions.

MR. C. W. KAYSER, after 15 years as chairman of the Sheffield Stainless Steel Manufacturers' Association, has resigned owing to ill-health. He is chairman and managing director of Kayser, Ellison & Company, Limited, of Sheffield. MR. LEWIS CHAPMAN, managing director of William Jessop & Sons, Limited, will succeed him.

MR. W. KILPATRICK, who was formerly managing director of Davy & United Engineering Company, Limited, has been appointed managing director of J. & H. McLaren, Limited, and of Kitson & Company, Limited, of Leeds. Mr. Kilpatrick was managing director of Duncan Stewart & Company prior to the merger with Davy United.

MR. C. L. RAILTON, of the Ministry of Supply Advisory Service on Welding, has been released to take up an appointment with the research department of Tube Investments, Limited. Previously on the welding staff of the Metropolitan Vickers Electrical Company, Limited, Manchester, Mr. Railton has for the past five years been associated with the Armaments Design Department as adviser on welding.

MR. G. W. LACEY, general sales manager responsible for the sales division of the British Aluminium Company, Limited, has been appointed a member of the board of directors of the company. MR. E. A. LANGHAM, who has recently returned from India, has taken up his appointment as sales manager in the sales division, from January 1. MR. A. W. LANGHAM, who has been acting sales manager and responsible for the sales and sales planning departments, has now taken up the appointment of sales planning manager.

MR. WILLIAM DAVIDSON, foreman patternmaker of M. Cockburn & Company, Limited, Gowan Bank Ironworks, Falkirk, was honoured recently on his retiral after about 60 years in the foundry trade, almost all of which was spent with this firm. A large gathering of the management, staff and workers met in the works canteen, under the chairmanship of Lt.-Col. R. L. Hunter, director and general manager. Mr. A. Stewart, director, presented Mr. Davidson with a cheque on behalf of the firm, while he also received a reading lamp and a purse of notes from the staff and workers.

MR. J. B. THOMAS has been appointed managing director of Hadfields, Limited, of Sheffield. Mr. Thomas is chairman of George Wolstenholm & Son, Limited, Sheffield, and of Ernest Newell & Company, Limited, and a director of George Clark (Sheffield), Limited. He joined Hadfields in 1917, and in 1922 was appointed financial advisor to the company. In 1936 Mr. Thomas severed his connection with Camm, Metcalfe & Company, and joined the board of Hadfields, Limited, as financial director. He became general manager in 1945 following the retirement of Sir Peter Brown and Major A. B. H. Clerke.

SIR FRANK NIXON, who has been elected a director of John Brown & Company, Limited, will become chairman of a special export company now being formed to promote the export trade of John Brown & Company, Limited, Thomas Firth & John Brown, Limited, and their subsidiary and associated companies. Sir Frank Nixon was formerly head of the Export Credits Guarantee Department, and during the war has been a managing director of the United Kingdom Commercial Corporation. He is relinquishing this post and the Treasury has agreed to release him from the Civil Service. He will, however, remain on the board of the United Kingdom Commercial Corporation and on the Council of the Export Credits Guarantee Department.

MR. W. S. AULT and MR. J. SIMPSON have been appointed directors of the Woodall-Duckham Vertical Retort & Oven Construction Company (1920), Limited. Mr. Ault has been a member of the company's staff for 31 years. He was educated at Birmingham Municipal Technical School, and served for four years on the engineering staff of the Birmingham Corporation Gas Department. Mr. Simpson, with the firm for 20 years, served a pupilage at Robert Dempster's, of Elland. He was a pilot-officer during the 1914-18 war. He held the appointment of chief assistant engineer and manager of Greenock Corporation Gas Department before joining the Woodall-Duckham Company in 1926.

DR. CHARLES FREDERICK GOODEVE, F.R.S., who was made a Knight Bachelor in the New Year Honours List, recently took up the appointment of Director of the British Iron and Steel Research Association. During the war, as Assistant Controller for Research and Development at the Admiralty, he was prominent both as a scientist and as organiser of the work of other scientists in the technical discoveries which played such a leading part in defeating magnetic mines, U-boats and other weapons in the enemy's armoury. He has a distinguished record in the fields of both pure and applied science. Before the war he was reader in physical chemistry at University College, London, and was for many years consultant and technical adviser to a number of big industrial companies.

Wills

HARPER, W. H., of Smethwick, retired boiler manufacturer	£15,934
GRIEVE, W. H., chairman and managing director of Lightalloys, Limited	£106,239
WYNN, MAJOR F. K., of Castle Bromwich, a director of Wynn, Timmins & Company, Limited, drop stampers and tool manufacturers, Birmingham...	£5,227
BIRD, MAJOR T. G., of Newcastle-upon-Tyne, managing director of Armstrong Whitworth (Pneumatic Tools), Limited, Jarrow Engineering & Shipbreaking Company, Jarrow Metal Industries, Limited, and of Sir W. G. Armstrong Whitworth & Company (Ironfounders), Limited	£24,164

AMERICAN EXCHANGE PAPER

Mr. Kenneth L. Clark, metallurgist, Naval Research Laboratory, Washington, D.C., and chairman of the American Foundrymen's Association Fluidity Testing Committee, has accepted the invitation of the Association to prepare for presentation before the 1946 meeting of the Institute of British Foundrymen, the annual Exchange Paper from the A.F.A. Mr. Clark's subject will cover recent developments in fluidity testing and control. The Exchange Paper arrangement was initiated in 1921 and has been continuous since that date. It is expected that there will be a similar Exchange Paper from the I.B.F. to be presented before the A.F.A. 50th anniversary congress in Cleveland next May.

THE BRITISH STANDARDS INSTITUTION, in its latest monthly information sheet, lists among new work started impact testing for cast iron.

NON-FERROUS SCRAP METAL PRICES

SALES AT M.O.S. DEPOTS

The Minister of Supply has issued the following list of prices of non-ferrous scrap metals. These are prices at Ministry of Supply depots at which the Minister is prepared to effect a sale to a buyer subject to having sufficient material of that particular quality available at a convenient depot at any particular time.

The list relates to the period of three months from January 1 to March 31, 1946, but is published without prejudice or commitment. Any inquiries regarding the list should be addressed in the first instance to: Directorate of N.F. Metals (Scrap Disposals Department), Euston House, London, N.W.1. All prices are per ton ex-works.

Copper.—Copper, clean untinned, cut up, £56 10s.; bright untinned copper wire, £57 10s.; No. 1 copper wire, £57; No. 2 copper wire, £55s. 10d.; shell band scrap other than turnings), £56 10s.; copper firebox plates, cut up, £57 10s.; copper turnings (including shell band turnings), £48; braziery copper, £53 10s.; cupro-nickel scrap, 80/20 webbing, £75 10s.; cupro-nickel scrap, defective cups and envelopes before filling, £70 10s.

Zinc.—Zinc scrap, £24.

Brass.—Brass ingots, £51; S.A.A. webbing, £48 10s.; defective cups and cases, £47 10s.; cut-offs and trimmings, £42 10s.; muffled cases, Grade A (electrically muffled), £47; muffled cases, Grade B, £45; turnings, loose, £37; turnings, masticated, £42; fired cases, £47; fired Q.F. cases, £48 17s.; Q.F. webbing, £49; Q.F. cut-offs and trimmings, £47 10s.; Q.F. defective cups and cases, £49; Q.F. turnings, £38; other 70/30 process and manufacturing scrap, £46 10s.; 70/30 metallics, £34; 60/40 rod swarf, £30 10s.; 60/40 metallics, £27; process and manufacturing scrap containing over 62 per cent. and up to 68 per cent. copper, £43 10s.; process and manufacturing scrap containing over 58 per cent. and up to 62 per cent. copper, £38 10s.; broken down fuse scrap, 60/40, £38; 85/15 gilding metal webbing, £52 10s.; 85/15 defective gilding metal cups and envelopes before filling, £50 10s.; 90/10 gilding metal webbing, £53 10s.; 90/10 gilding metal defective cups and envelopes before filling, £51 10s.; cap metal webbing, 95/5, £54 10s.

Gunmetal.—Scrap, Admiralty, 88/10/2, £77; scrap, Admiralty, £72 10s.

Nickel Silver.—Process and manufactured scrap, 10 per cent., £50; 15 per cent., £56; 18 per cent., £60; 20 per cent., £63.

Scrap cupro-nickel bullet envelopes (maximum antimonial lead content 0.08 per cent.), £67.

Scrap gilding metal bullet envelopes (maximum antimonial lead content 4 per cent.), £42.

INDUSTRIAL & MECHANICAL ENGINEERS, LIMITED, is being wound up voluntarily. Mr. A. Scotten, 34-40, Ludgate Hill, London, E.C.4, is the liquidator.

THE HEATHCOTE ENGINEERING COMPANY, LIMITED, is being wound up voluntarily. Mr. G. Dickenson, chartered accountant, has been appointed liquidator.

NEWS IN BRIEF

EMPLOYEES OF THE Grahamston Iron Company, Limited, Falkirk, contributed the sum of £450 to hospitals and various institutions during 1945.

ASHMORE, BENSON, PEASE & COMPANY, LIMITED, Stockton-on-Tees, have been awarded the contract for the installation of two cast-iron oxide purifiers in the Stockton municipal gasworks at a cost of £15,460.

THE NATIONAL CASH REGISTER COMPANY, which has hitherto imported from its factory in the United States all the machines it has sold in this country, is to begin manufacturing cash registers at a new factory at Dundee during the spring.

THE SOUTH TEES-SIDE JOINT TOWN PLANNING COMMITTEE, at a meeting at Middlesbrough, approved proposals by North Riding County Council for road developments to serve new works proposed by Dorman, Long & Company, Limited, and Imperial Chemical Industries, Limited, and for new docks for the Tees Conservancy Commission.

MATHER & PLATT, LIMITED, of Manchester, have acquired the business of Thomas Jones & Sons (Farnworth), Limited, Albert Road and St. Germain Street, Farnworth, Bolton, Lancs. They will continue to operate the foundries as an ancillary to their main business, and retain the services of the existing staff of 50. The Little Lever undertaking of Thomas Jones & Sons is not included in the sale.

THE CARRON COMPANY was closely associated with the construction and development of James Watt's steam engine and gave the engineer every encouragement and support to bring his ideas to fruition. The cast-iron cylinder of the engine is now in the yard of the Bo'ness Gas Company, and the Carron Company has offered to bear a share of the cost of removing it to a more suitable site on Kinneil Estate.

THE MINISTER OF SUPPLY AND AIRCRAFT PRODUCTION has agreed to release the following Regional Controllers:—Mr. H. C. M. Austen (M.O.S.), South Western Region; Major V. W. Eyre (M.A.P.), London and S.E. Region; Mr. C. W. Haynes (M.O.S.), Midland Region; Lt.-Col. H. Gordon Luhrs (M.O.S.), London and S.E. Region; Mr. C. A. Oakley (M.A.P.), Scottish Region; Mr. V. Proctor (M.O.S.), East and West Ridings; and Mr. F. A. M. Vincent (M.A.P.), East and West Ridings.

SPEAKING AT THE annual dinner of the Birmingham Metallurgical Society, Dr. J. E. Hurst, president of the Staffordshire Iron and Steel Institute, referred to the progress in the development of metals. The 42 years since the foundation of the society, he said, had seen epic progress in metallurgy. The alloy steels, the light alloys, and the stainless steels—the last a boon to the housewife—had all made their appearance in that time, and in that progress Birmingham metallurgists had played a useful part.

WILLIAM JESSOP & SONS, LIMITED, and their associated company, J. J. Saville & Company, Limited, will shortly close their national services fund, which was inaugurated to assist dependants of employees who joined H.M. Forces or took up other full-time national service. The fund was administered by a committee of which Mr. Lewis Chapman, managing director of both companies, was chairman, and was raised and maintained by contributions from the directors, staff and men and women in all branches of the works. It is estimated that by the time the fund is finally closed some £36,000 will have been distributed.

IN SOME 7,000 of his Majesty's ships, "action stations" during the war was sounded on a bell which had been cast by the Alliance Foundry Company, Limited, of Luton. During the war the company also produced for the Admiralty 9,780 tons of grey iron, semi-steel alloyed cast iron, and non-ferrous metals, 23,750 naval fittings, ventilators, fairleads, and engine water strainers for motor torpedo boats, and 3,750 cast-iron sinkers. Castings were supplied for "Mulberry" Harbour, food production, fire fighting equipment, tanks, armoured cars, jigs and tools for aircraft production, barrage balloon and target winches. The Army and the R.A.F. were also supplied with 121,500 parts for Radar and searchlight equipment, 230,000 mortar bomb fuse castings, and 5,000 parachute counterweights.

REGIONAL CONTROLLERS APPOINTED

The following appointments as Regional Controller have now been made in consequence of the decision, recently announced, to merge the regional organisations of the Ministries of Supply and Aircraft Production under one controller in each region:—

Northern (Newcastle-upon-Tyne), Mr. F. C. Wake. East and West Ridings (Sheffield), Mr. W. F. Fletcher. North Midland (Nottingham), Mr. R. H. Tate. Eastern Region (Cambridge), Mr. W. Redpath. London and South-Eastern (London), Mr. W. D. L. Roberts. Southern (Reading), Mr. J. A. Goddard. South-Western (Bristol), Mr. J. H. Larrard. Wales (Cardiff), Mr. B. M. Smith. Midland Region (Birmingham), Mr. S. A. Davis. North-Western (Manchester), Mr. A. Neate. Scotland (Glasgow), Major Jackson Millar, Northern Ireland (Belfast), Mr. S. O. Hicks.

IMPORTS AND EXPORTS OF IRON & STEEL

Imports of iron and steel and manufactures thereof in November, 1945, were valued at £455,000, according to Board of Trade returns. There was a big reduction compared with November, 1944, when the total value was £2,241,373. Imports in the 11 months ended November amounted to £6,281,708, as against £30,493,012 in the 11 months of 1944. Imports of iron ore and scrap in November were valued at £1,404,149 (£817,498 in November, 1944), and in the 11 months at £14,461,763 (£8,485,128 in 1944).

Exports of iron and steel and manufactures thereof totalled £2,116,255 in November, 1945, and £17,257,218 in the 11 months, against £1,028,400 and £7,900,737 in November and the 11 months of 1944 respectively.

THE MODERN PIG

IF YOU WANT...
clean iron, free from sand, free from sows ...uniform analysis... convenient size...easy handling... specify
STANTON MACHINE CAST PIG IRON

SPECIFICATION

WEIGHT	80-90 lbs.
Length	22 inches
Width	8½ inches
Thickness	3⅜ inches

(at notch 2½ inches).

Made in our well-known
STANTON, HOLWELL & RIXONS BRANDS

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Polin, 130, Regents Park Road, London, N.3—Engineers, etc. £1,000.

Rockwell Machine Tool Company—£40,000. W. B. Lindley, Dunraven, Roundhay, Leeds, 8.

Jigs & Tools (Stockport), The Works, High Street, Stockport—£5,000. H. D. Knight and K. D. Field.

T. Chappelow & Son, Atlas Foundry, Warwick Road, Batley, Yorks—Ironfounders. £2,500. E. Chappelow.

Primon Engineering Company, 270, Old Brompton Road, London, S.W.5—£500. N. Daglish and V. E. Pritchard.

Ashdown Bros. & Company (Engineers), 13, Rosamond Road, Bedford—£1,000. R. E., E. R., L. A., and A. W. Ashdown.

C. F. Brouncker & Company, 815, Sidcup Road, London, S.E.9—Engineers, etc. £2,000. C. F. Brouncker and M. Norman.

New Equipment, Darlington Road, Croxdale, Durham—Engineers and manufacturers of tubular products. £5,000. F. and D. Corner.

Associate Toolmaking & Engineering Company, 6-9, Surrey Street, London, W.C.2—£1,000. E. L. Watt, F. J. Hartfree, and N. A. Jackson.

W. B. P. Coleman, Hollinside Halt, Lanchester, Co. Durham—Engineers, etc. £1,000. W. B. P. and S. A. D. Coleman, and J. Hutchinson.

Toolchrome, Annis Road, London, E.9—Chromium, electro and nickel platers, etc. £2,500. J. E. Ball, R. H. Coleman and W. G. Blackburn.

R. B. Brooke & Sons (Engineers), Grove Works, Swan Lane, Lockwood, Huddersfield—Textile engineers. £5,000. R. B. and E. Brooke.

Liversidge & Atkinson, 10, Borrowdale Avenue, Harrow Weald, Middx.—Ironfounders, etc. £100. T. and I. K. Liversidge and E. W. Atkinson.

Lovell & Hanson, 11, Dingle Close, Oakham, Dudley, Worcs—Brass, bronze and ironfounders, etc. £15,000. R. H. Lovell and K. C. Hanson.

K. & H. (London)—Hardware manufacturers, engineers, etc. £100. T. F. J. Hobson and M. Klinger, 87, Durlston Road, London, E.5.

E. Farrell & Son, West End Engineering Works, Chadwick Street, Oldham—Textile and mechanical engineers, etc. £5,000. E. and T. Farrell.

Pearson Phillips, Mowbray House, 14, Norfolk Street, London, W.C.2—Engineers, tool makers, etc. £1,000. J. H. Phillips and L. O. Shrubsole.

Charles Kendall & Partners, 3, North Court, Great Peter Street, London, S.W.1—Engineers, etc. £5,000. C. Kendall, T. W. Pragnell, and G. E. Peck.

G.K.P.—Manufacturers of and dealers in electrical and mechanical apparatus, etc. £10,000. G. Glassecoo, 97, Cannon Street, London, E.C., subscriber.

Northern Tool & Gear Company, 25, Crown Street, Aberdeen—£3,000. J. Strachan, G. A. Summers, J. M'Donald, W. D. Massie, and D. Duncan.

Alcester Engineering Company, 5, Bleachfield Street, Alcester, Warwicks—£3,000. H. W. C. Thompson, W. J. Mean, E. H. Partridge, and P. Burden.

Nicholson & Rhodes, Old Steel Wharf, Effingham Road, Sheffield—Iron, steel and scrap merchants. £2,000. W. A. Nicholson and T. W. Rhodes.

J. W. Draper & Sons—Dealers in scrap metals, etc. £2,000. J. W. Draper, senr., 149, Alexandra Road, Grimsby, J. W. Draper, junr., and L. Draper.

P.L.I., 12, Broad Court, London, W.C.2—Electrical and general engineers, etc. £500. F. C. and J. Gardner, J. J. Tanner, and R. W. Reynolds.

Clugston Staveley—Merchants and manufacturers of foamed and tarred slag, etc. £25,000. W. Hildreth, 80, North Park Avenue, Leeds, 8, subscriber.

Chroframes, Park Works, High Haden Road, Old Hill, Staffs—Manufacturers of metal pressings, etc. £500. C. H. Lee, J. Wood, and W. H. Grice.

John Beedney, 81, Bell Street, Henley-on-Thames—Manufacturers of and dealers in machinery, plant, etc. £100. C. P. C. Davies and W. A. Fuller.

Hamilton (Rochdale) (1945), Cheetham Street, Rochdale, Lancs.—Sheet-metal workers, etc. £3,000. B. J. E. Nailous, E. H. Moorhouse, and J. Ward.

Rolamatic, 3/4, Clements Inn, Strand, London, W.C.2—Engineers, etc. £5,000. C. R. Anderson, D. W. de Souza, R. A. Foster, and K. G. Loach.

Sec Frame, 25, Upper Brook Street, London, W.1—Manufacturers of steel frames for buildings. £10,000. B. Brunton, B. P. H. Preston, and J. R. Stopford.

Keeble & Browne, Creechurch House, Creechurch Lane, London, E.C.—Dealers in metals, machinery, tools, etc. £100. M. T. Browne and H. A. Keeble.

Harwood & Cornes, Station Approach, Hall Green Station, Stratford Road, Birmingham—Scrap dealers, etc. £5,000. J. and G. S. Harwood and W. Cornes.

E. Marriott & Company, 200, Conybeare Street, Birmingham, 12—Electroplaters, brass founders, metal workers, etc. £500. E. Marriott and W. T. L. Holt.

Hillingdon Manufacturing Company, Butler Street, Uxbridge Road, Hillingdon, Mdx—Manufacturing and consulting engineers, etc. £5,000. P. J. and M. Rogers.

W. G. Mott & Company, 130, St. Albans Avenue, Chiswick, London, W.4—Manufacturers and suppliers of aluminium castings, etc. £100. W. G. and D. Mott.

Nutype Tools, The Tilt, Cobham, Surrey—Manufacturers of and dealers in precision and scientific instruments, etc. £2,000. J. C. G. Wegerif and R. H. Herbert.

Gillett Flower Pistons—Manufacturers of and dealers in pistons, piston rings, etc. £20,000. M. V. Hancock, 1, Diban Avenue, Elm Park, Romford, subscriber.

TO SLAG PENETRATION

SLAG penetration of refractory materials normally accompanied by erosion, surface spalling, shrinkage, etc., is frequently responsible for the ultimate failure of refractories. To reduce the destructive effect of slag penetration, volume-stable, dense, low-porosity, low-permeability bricks, with the correct chemical composition, must be used. A characteristic of G.R. products is that they possess these necessary qualities and thus ensure minimum slag penetration. The services of G.R. engineers are available on request, to users, on the choice and application of refractories.

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Raw Material Markets

IRON AND STEEL

Pig-iron prices have advanced much more steeply than the increases on steel products. At £8 3s. per ton, Cleveland pig-iron is 35s. per ton dearer than it was a year ago, and Scottish foundry iron is up £2 per ton. But the foundries must have iron and, indeed, bigger supplies will be needed when the labour is available to accelerate the production of light castings. At present the supply of foundry iron is not plentiful and it looks as though steps will have to be taken at an early date to increase the output. Other grades of iron are not so scarce. Refined iron makers, for example, could handle more business than has been offered of late, while users of hematite and low- and medium-phosphorus iron have no difficulty in covering their requirements. In no case, however, is there a big surplus and the export of pig-iron is still prohibited.

Avoidance of a bottleneck in the re-rolling industry is clearly dependent on the continued import of semis from overseas, and further purchases of material from the Dominions are expected. There is still a wide gap between supply and demand for billets, blooms and sheet bars. Re-rollers have a large volume of work in hand, and although operations have not been interrupted by an absolute lack of material, the position is so tight that users are willing to accept scraps, defective billets, or any kind of material which can be put through the mills.

The plate and section mills have taken on a fairly large volume of export orders for the current period and, as the requirements of home industries are increasing, full-scale activity is assured for months to come. Heavy plates are not so freely specified as the lighter sizes and much the same conditions apply to the market for joists and sections. Maximum outputs of colliery and railway equipment are required, whilst the call for steel sheets is overwhelming. There is a substantial difference between home and export prices, but the tonnages which can be allocated for shipment are limited and, in fact, orders already booked will absorb practically the whole of the output for the first half of the year.

NON-FERROUS METALS

From Washington comes the news that the International Tin Committee is to continue to allocate tin ores and concentrates. The countries agreeing to participate include the United States, Belgium, the Netherlands, France, and the United Kingdom.

Copper consumers in this country continue to be in the dark with regard to the Government's plans for this metal. The formation of a trade association of leading rod manufacturers is announced. It is called the Extruded Brass and Copper Alloy Association, and will fix basis prices for brass rod, and a schedule of extras.

The outlook for zinc producers can be considered definitely favourable. The home trade continues to expand, although rolling and tube mills are hindered by the labour shortage, which is preventing them from accepting numerous orders. Zinc alloy die-castings, although not in any great demand at the moment, should soon be required in larger quantities.

The Lead Manufacturers' Development Association, Limited, has been registered as a company without share capital, to carry out development and research work on behalf of the industry.

The Ministry of Supply announce that, owing to the world shortage of lead, it has become necessary to ration supplies available to the United Kingdom and it will no longer be possible for consumers to obtain their full requirements.

For the time being the basis of rationing will be to restrict deliveries of imported lead metal by the Directorate of Non-Ferrous Metals to each consumer of over 2 tons per month to a percentage of his average monthly consumption of such metal in the four months' period September to December, 1945, subject to adjustment in relation to his stock position. For the first quarter of 1946 the rate will be 80 per cent. and deliveries already made in January will count against this allocation.

The issue of licences for unwrought lead of guaranteed 99.97 per cent. lead content will be resumed forthwith, but the tonnage to be licensed during the first quarter of 1946 will, for each month of the quarter, be restricted to 80 per cent. of the average monthly consumption of such lead in the period September to December, 1945. Application may be made for one licence to cover the whole quarter.

Applications for licences for unwrought lead of less than 99.97 per cent. lead content and for scrap lead of all descriptions should be made on the basis in force before December 14, 1945.

Coincident with this announcement comes the intimation, not unexpected, of an increase in price, "in order," as the Ministry of Supply states, "to bring the selling prices of lead in the United Kingdom more closely into line with current purchase costs." The increase is made under the Control of Non-Ferrous Metals (No. 20) Order, which took effect on January 15, and is of the order of £9 per ton, so that the new price will be £39 per ton for pig-lead except for the quality known as "English," which will be £40 10s. per ton.

Holders of valid licences to purchase lead metal (as sold by the Directorate of Non-Ferrous Metals) granted on or before January 14, 1946, may, on application to the Directorate at the Grand Hotel, Rugby, cover themselves by purchases, where they have not already done so, against such licences up to and including January 28, 1946, at the maximum prices ruling on January 14.

OBITUARY

MR. R. H. BRIGGS, editor of the "Overseas Engineer," and formerly of the Technical Press Censorship, Ministry of Information, died suddenly on January 3.